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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

ED 066470

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

INSULATING-MACHINE OPERATOR (insulated wire) 7-00.210

PAIRING-MACHINE OPERATOR (insulated wire) 7-00.220

B-588 S-308

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U. S. Employment Service
in Cooperation with
California State Employment Service

August 1964

GATB #2508

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

INSULATING-MACHINE OPERATOR (insulated wire) 7-00.210
PAIRING-MACHINE OPERATOR (insulated wire) 7-00.220

B-588 S-308

Summary

The General Aptitude Test Battery, B-1002B, was administered to a final sample of 54 individuals employed as Insulating-Machine Operators 7-00.210 and Pairing-Machine Operators 7-00.220 at the General Cable Corporation, Emeryville, California. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, and their combined selective efficiency, Antitudes P-Form Perception, K-Motor Coordination, and M-Manual Dexterity were selected for inclusion in the final norms.

GATB Norms for Insulating-Machine Operator (insulated wire) 7-00.210, B-588.S-308
Pairing-Machine Operator (insulated wire) 7-00.220, B-588. S-308

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
P	CB-1-A CB-1-L	80	P	Part 5 Part 7	80
T	CB-1-G CB-1-K	80	K	Part 8	85
M	CB-1-M CB-1-N	80	M	Part 9 Part10	80

Effectiveness of Norms

The data in Table IV indicate that only 72 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 87 percent would have been good workers. 28 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 13 percent would have been poor workers.

TECHNICAL REPORT

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupations of Insulating-Machine Operator 7-00.210 and Pairing-Machine Operator 7-00.220.

II. Sample

The GATB, B-1002B was administered during the period April 1962 through February 1964 to a final sample of 3 women and 51 men who worked interchangeably as Insulating-Machine Operators 7-00.210 and Pairing-Machine Operators 7-00.220 at the General Cable Corporation, Emeryville, California. The individuals in the sample were tested either as local office applicants at offices of the California State Employment Service or as employees who were recently hired and were in the process of completing the on-the-job training given by the company.

The individuals in the sample were selected for employment against the following criteria: (1) minimum age - 18 years; (2) minimum education - 10th grade; (3) pass physical examination; (4) able to work on any one of three shifts. Each individual completed the on-the-job training period (2 - 4 weeks) for performance of both the Insulating-Machine Operator and Pairing-Machine Operator job duties. In the work situation, individuals are moved from one machine to the other as the need arises.

TABLE I

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

N = 54	M	σ	Range	r
Age (years)	27.0	5.4	20-46	-.041
Education (years)	11.5	1.1	8-14	-.054
Experience (months)	4.2	2.2	2-9	.333*

*Significant at the .05 level.

III. Job Description

Job Title: Insulating-Machine Operator (insulated wire) 7-00.210

Job Summary: Sets up and tends one insulating machine with five spindles, each of which wraps colored paper tape and forms a loose tube around the conductor (a single copper wire).

Work Performed: Sets up machine: Reads run tag to determine quantity and color of paper tape needed. For each spindle, places one roll of paper tape on each paper turntable and remaining rolls on each paper supply holder. Feeds copper wire (conductor) by hand from supply reel, successively through center of turntable, forming dies, paper supply holder, around capstan, over wire guides and attaches to take-up reel. Threads paper tape from roll on turntable around guide rollers and attaches to wire, using gummed paper. Turns turntable by hand until paper is wound taut around wire. Pushes button to start motor and lifts clutch lever to start wire feed and paper tape winding helically around wire.

Adjusts tension on wire and tape: Pulls lightly on wire above take-up reel on each spindle to judge tension on wire. Turns adjusting nuts on appropriate guides by hand to take up slack or ease tension. Feels insulated wire to be sure tape is wound neither too loosely nor too tightly around wire. Observes spindles in operation to ensure that wire is being insulated correctly and makes adjustments as necessary to insure correct wire feed, to maintain correct wire tension and to ensure even winding on take-up reel.

Brazes wire and splices tape: When wire breaks or new reel is started, places exposed end in electrode clamp. Peels paper from insulated end of wire and places wire in adjacent clamp so that ends overlap. Snips off excess wire using wire cutters and, with fingers, butts wire ends. Presses button to heat wires and touches joint with thin silver-solder wire. Removes brazed wire from clamps, pulls wire with both hands to test strength of joint. Lifts clutch lever to take up slack in wire. Splices ends of paper tape by butting ends and sealing with gummed paper. Turns turntable by hand until slack is taken up and paper is positioned around wire.

Replenishes tape supply: Loosens die-holding setscrew on paper tape supply holder by hand, lowers dies from die holder, lowers one roll onto turntable below, and centers roll on raised center portion. Repositions dies in die holder and tightens setscrews.

Prepares tape supply: Rubs parafin over both surfaces of each pad in supply to keep moisture in pad and to lubricate surface of the faceplate and forming die.

Completes daily production report: Notes defects, if any, on run tag along with identifying information such as footage, date, shift and operator number and attaches to wire on bobbin.

Job Title: Pairing-Machine Operator (insulated wire) 7-00.220

Job Summary: Sets up and tends two semi-automatic pairing machines which twist two insulated wires together to form the basic transmission circuit.

Work Performed: Sets up machine: Reviews run tag to determine quantity of wire (insulated conductor) to be paired (twisted together). Raises machine cover, releases bobbin locks, removes empty bobbins by lifting and sliding bobbins from shaft and places full bobbins on shaft. Attaches and tightens bobbins locks. After removing full take-up bobbin, places empty bobbin on shaft and attaches and tightens bobbin lock. Checks color coded gear combination to determine if pairing lay (length of twist) agrees with specification on run tag. Notifies Gear Changer if change needed.

Sets up pairing machines: Pulls a few feet of wire from each bobbin and twists the ends together to form one paired wire. Threads paired wire through guides on bow, around capstan, over guide rollers and attaches end of paired wire to take-up bobbin. Turns bobbin by hand to take up slack. Lowers machine cover and sets counter.

Tends machines: Presses button to start take-up and pairing motors. Constantly observes machines for correct operation. Turns adjustment screws to maintain correct feed and adjusts rheostat to maintain correct running, stopping and take-up tension. Presses button to stop machine when take-up bobbin is filled. After removing filled bobbin, replaces with empty bobbin. When supply bobbin becomes depleted, stops machine, removes empty supply, replaces with full bobbin and presses button to start machine.

Repairs bare spots in insulation or break in wire: When bare spot in insulation (shiner) appears, machine stops. Takes length of gummed paper, splices end to one end of broken paper tape, coils paper around wire to cover exposed area of wire and splices at other end of broken paper tape. When wire breaks, presses button to stop machine. Peels paper tape from each end of broken wire. Places each end in electrode clamp so that ends overlap. At the point where wires overlap, snips off excess wire using wire cutters, and with fingers, butts wire ends. Presses button to heat wires and touches joint with thin silver-solder wire. Removes brazed wire from clamps, pulls wire with both hands to test strength of joint. Splices broken ends of paper tape using gummed paper tape. Turns take-up bobbin by hand to take up slack.

Tests paired wires for continuity of and shorts in circuit: Touches paired wire ends with lead wires of circuit tester. Signal light indicates presence or absence of shorts and/or continuity.

Completes daily production report: Notes defects, if any, on run tag along with identifying information such as footage, date, shift and operator number and attaches to wire on bobbin.

IV. Experimental Battery

All the tests of the GATB, B-1002B, were administered to the sample group.

V. Criterion

Criterion data were collected after each individual had completed the on-the-job training period (2 - 4 weeks). These data consisted of two sets of supervisory ratings made by the first-line supervisor on an adaptation of USES Form SP-21 "Descriptive Rating Scale." The second ratings were obtained 15 days after the first ratings. The rating scale consisted of nine items covering different aspects of job performance, with five alternatives for each item. Weights of one through five, indicating the degree of job proficiency obtained, were assigned to the alternatives. A reliability coefficient of .84 was obtained for the criterion. The final criterion consisted of the sum of the two ratings. The distribution of the final criterion scores ranged from 36-88, with a mean score of 63.3 and a standard deviation of 11.6.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of the job analysis data, the following aptitudes were rated "important" for success in these occupations:

Form Perception (P) - required to perceive, check, and verify color coded gear combinations to insure that the length of twist (pairing-machine) agrees with specifications to run tag; to determine degree of wire tension needed to insure even winding on (insulating-machine) take-up reel; and to judge when insulating tape fails to wind, in tubular form, around wire according to company standards.

Motor Coordination (K) - required to rapidly perform such tasks as attaching paper tape to wire, splicing tape or wire, and making machine adjustments to insure that correct wire tension is maintained.

Finger Dexterity (F) and Manual Dexterity (M) - required to manipulate wire, paper tape, levers, and hand tools when making machine set ups, adjustments, and replacing wire and tape.

On the basis of the job analysis data V-Verbal Aptitude and N-Numerical Aptitude were rated "irrelevant" for success in these occupations.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 54

Aptitudes	M	σ	r
G-Intelligence	93.9	15.4	.165
V-Verbal Aptitude	92.3	13.4	.012
N-Numerical Aptitude	91.8	17.0	.108
S-Spatial Aptitude	104.5	18.3	.259
P-Form Perception	100.8	18.3	.348**
Q-Clerical Perception	97.9	13.7	.187
K-Motor Coordination	101.1	15.6	.221
F-Finger Dexterity	98.8	18.2	.124
M-Manual Dexterity	107.5	18.0	.121

**Significant at the .01 level.

C. Selection of Test Norms:

TABLE III

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important					X		X	X	X
Irrelevant		X	X						
Relatively High Mean				X	X		X		X
Relatively Low Sigma		X				X			
Significant Correlation with Criterion					X				
Aptitudes to be Considered for Trial Norms					P		K		M

Trial norms consisting of various combinations of Aptitudes P, K and M with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1002 norms consisting of P-80, K-85 and M-80 had the best selective efficiency.

VII. Validity of Norms (Predicted)

The validity of the norms was determined by computing the Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 28 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV shows the relationship between test norms consisting of Aptitudes P, K and M with critical scores of 80, 85 and 80, respectively, and the dichotomized criterion for Insulating-Machine Operator 7-00.210 and Pairing-Machine Operator 7-00.220. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Validity of Test Norms for
Insulating-Machine Operator 7-00.210
Pairing-Machine Operator 7-00.220
(P-80, K-85, M-80)

N = 54	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	5	34	39
Poor Workers	10	5	15
Total	15	39	54

Phi Coefficient = .538
X^2 = 15.628
P/2 < .0005

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes P, K and M with minimum scores of 80, 85 and 80, respectively, have been established as B-1002 norms for the occupations of Insulating-Machine Operator 7-00.210 and Pairing-Machine Operator 7-00.220. The equivalent B-1001 norms consist of P-80, T-80 and M-80.

IX. Determination of Occupational Aptitude Pattern

The data for this study met the requirements for incorporating the occupations studied into OAP-31 which is shown in Section II of the Guide to the Use of the General Aptitude Test Battery, January 1962